

Andrzej Adamski, Krzysztof Florek: **ITS: Intelligent Transportation Systems – Multi-Criteria Control Problems** • Automatyka/Automatics 2013, Vol. 17, No. 1

The ITS systems offers high capabilities for the implementation of advanced multi-criteria traffic control methods. The crucial problems in this area are related with adequate flexibility of control actions to the estimated and predicted traffic demand. Very illustrative examples in this area are demand-supply behavioral interactions visible in the operation of an urban network where network link flows are a result of such interactions. The ITS systems offering dedicated services like VMS (Variable Message Signs), v-v/v-i (vehicle to vehicle/vehicle to infrastructure) communication, RGS (Route Guidance Systems) which can influence the network users behavioral patterns but the level of these influences is to a high degree uncertain. The representative set of traffic flows are crucial inputs for area-wide traffic coordination and control problems. In the paper the proposal of real-time recognition of behavioral patterns on different layers of HITS (Hierarchical Integrated multi-layer Transportation System) system is presented especially in the context of intelligent multi-criteria users-oriented traffic control actions to be a reaction on recognized users behavioral and estimation of these behavioral patterns. The advantages of the proposed approach are illustrated by examples of real-time solutions and comparisons with the existing off-line intuitive solutions.

Keywords: *ITS systems, multi-criteria control, multi-layer system structures, traffic assignment in networks*

Andon Coleman, Janusz Zalewski: **A Study of Real-time Memory Management: Evaluating Operating System's Performance** • Automatyka/ Automatics 2013, Vol. 17, No. 1

This paper addresses computer memory management with real-time operation in mind. Two essential memory allocation algorithms are analyzed, Hoard and jemalloc, as well as a default algorithm for each specific platform considered. Benchmarking experiments for four platforms, Mac OS X, Linux, Windows NT, and VxWorks, were conducted and respective data collected and analyzed.

Keywords: *memory management, memory allocation, real time, jemalloc algorithm, Hoard algorithm, benchmarking*

Marcin Jamro, Bartosz Trybus: **Running and Testing the Programs Created in IEC 61131-3 Languages** • Automatyka/ Automatics 2013, Vol. 17, No. 1

This paper presents new features for testing and running of IEC 61131-3 POU (Program Organization Units) which are available in the CPDev engineering environment. Testing can be done either via simulation or in on-line mode. A data sources mechanism is used to test programs running on various target platforms. There are tools for the debugging of programs created in graphical languages like FBD or LD, as well as a tool for the final commissioning. One of the newest mechanisms added to CPDev environment is the possibility of defining POU-oriented tests. Two ways of specifying unit tests for functions, function blocks or programs are available i.e. via the dedicated test definition language CPTest or using tables.

Keywords: *IEC 61131-3, testing, debugging, unit tests*

Krzysztof Kaczor, Grzegorz J. Nalepa: **A Critical Overview of Methods for Rules Interoperability. Position Paper** • Automatyka/ Automatics 2013, Vol. 17, No. 1

Rules are commonly used as a declarative method for knowledge representation. In the past, they were used in Rule-Based expert systems. Today they found application in such technologies as Complex Event Processing (CEP), Business Rules (BR), Business Processes Model and Notation and Semantic Web (SW). Despite their maturity, many unsolved problems still exist. One of them is related with rules interoperability and knowledge interchange. During the years many research were conducted and several methods were developed. Nevertheless, these methods suffer from their general and complex nature, which causes that the practical tool support is very weak.

Keywords: *rule interchange, knowledge interoperability, rule languages, rule representation, expert systems, rules, business rules*

Radosław Klimek: **From Workflow Design Patterns to Logical Specifications** • Automatyka/ Automatics 2013, Vol. 17, No. 1

This work concerns issues related to automatic generation of logical specifications. Logical specifications can be extracted directly from developed software models. Received specification can be

used in the process of a system formal verification using a deductive approach. The generated logical specification is just a set of temporal logic formulas as well as verified system properties are expressed in temporal logic. The extraction process is based on the idea of organizing the whole analyzed model as a set of certain design patterns of control flows. A method of automatic transformation of workflow design patterns to temporal logic formulas is proposed. These formulas constitute a logical specification and may be the first step towards a formal verification of system correctness using any method of the deduction-based reasoning. Applying the presented concepts enables bridging the gap between naturalness and intuitive of the deductive inference and the difficulty of its practical application in the case of software models.

Keywords: *formal verification, temporal logic, deduction, semantic tableaux design patterns, generating logical specification*

Maciej Rosół, Dawid Knapik, Dariusz Marchewka, Krzysztof Kólek, Andrzej Turnau: **Analysis of Industrial PROFINET in the Task of Controlling a Dynamic System** • Automatyka/ Automatics 2013, Vol. 17, No. 1

This paper analyses the behaviour of industrial network PROFINET for time determinism during the transfer of controls and measurements in real time. The subject of interest is the performance of the network control system. An experimentation platform is described. An analysis of jitter in sampling period is provided. Test results demonstrating advantages of communication using PROFINET standard are presented.

Keywords: *PROFINET network, real-time control, jitter analysis*

Mariusz Rudnicki, Jan Schmidt, Aleksander Schmidt, Wojciech Leśniak: **Acoustic Processor of the MCM Sonar** • Automatyka/ Automatics 2013, Vol. 17, No. 1

This paper presents the concept of an acoustic processor of the mine countermeasure sonar. Developed at the Department of Marine Electronics Systems, Gdansk University of Technology, the acoustic processor is an element of the MG-89, a modernised underwater acoustic station. The focus of the article is on the modules of the processor. They are responsible for sampling analogue signals and implementing the algorithms controlling the measurement cycle and digital signal processing. As it performs the above functions, the device should be highly reliable and resistant to

mechanical and weather conditions and ensure a user friendly operation. The functions of the processor software should help with object detection and classification. In addition to these properties, the acoustic processor should operate in real time. The results of measurements should be displayed with the shortest possible delay in relation to sounding signals to allow the operator to take decisions quickly and establish if the object poses a risk.

Keywords: *MCM sonar, second order sampling, digital phase beamformer, Fourier transform, spatial frequency, VMEBus*

Andrzej Turnau, Dawid Knapik, Dariusz Marchewka, Maciej Rosół, Krzysztof Kołek, Przemysław Gorczyca: **The Real-time Network Control of the Inverted Pendulum System Based on Siemens Hardware** • *Automatyka/ Automatics* 2013, Vol. 17, No. 1

A pendulum on a cart system is often regarded as benchmark for control algorithms. In the paper such feature of the inverted pendulum is used to verify complex control system. Design and implementation of a networked control system containing a PLC and a servo driver is described. A control algorithm for inverted pendulum is shown and experiments results are presented. The findings may be used in a networked control system verification.

Keywords: *networked control system, real-time control, servomotor*

Sławomir Samolej, Tomasz Rogalski, Grzegorz Kopecki, Andrzej Tomczyk: **The Integration of a Prototype Pitch Control Application with IMA2G Devices** • *Automatyka/ Automatics* 2013, Vol. 17, No. 1

This paper reports the integration of a pitch control application into an experimental integrated modular avionics hardware-software module. The reported research was conducted within SCARLETT European program. A set of practical integration rules crucial from the development process perspective have been enumerated.

Keywords: *hard real-time systems, distributed systems, integrated modular avionics, control*

Adam Sędziwy, Leszek Kotulski: **Intelligent City Lighting Supported by Graph-based Multiagent System** • *Automatyka/ Automatics* 2013, Vol. 17, No. 1

The growing costs of energy and environmental care stimulate the development of technologies reducing the energy usage. In this

paper we discuss the case of an intelligent city lighting system which acts towards fitting the actual environment needs related to lighting. It is accomplished by performing some actions when an environment state changes but also by predicting the state changes on the basis of data provided by sensors. The problem complexity requires using formal model of a system enabling a problem decomposition and processing parallelization.

Keywords: *intelligent lighting, multiagent system, graph*

Piotr Szwed, Wojciech Chmiel, Stanisław Jędrusik, Piotr Kadłuczka: **Business Processes in a Distributed Surveillance System Integrated Through Workflow** • Automatyka/ Automatics 2013, Vol. 17, No. 1

SIMPOZ project aims at building a highly configurable system for surveillance of public areas and objects of a special importance based on the analysis of digital images. Distributed nature and potential diversity of monitoring features, a large number of alarm signals fed by various sensors, the need to ensure a flexible event flow management and tailored to needs emergency response processes were motivations to utilize workflow as a management and integration layer. Implementation of workflow processes was preceded by business modeling with ArchiMate language. The presented models of business processes reflect the specificity and characteristics of surveillance systems: reactive character, event driven control and a large number of asynchronous data flows. Lessons learned indicate, that ArchiMate models in spite of the smaller set of dedicated behavioral constructs with respect to for example BPMN, after adopting certain modeling conventions, allow to reach high level of expressiveness.

Keywords: *surveillance systems, workflows, business modeling, ArchiMate*

Piotr Szwed, Igor Wojnicki, Sebastian Ernst, Andrzej Głowacz: **Evaluation of a Dynamic Map Architecture with ATAM** • Automatyka/ Automatics 2013, Vol. 17, No. 1

Dynamic Map can be considered a complex information system, composed of spatial databases, storing static and dynamic data relevant for urban traffic, as well as a set of software modules responsible for data collection, interpretation and provision. The data originates from a network of sensors, both fixed (e.g. video detectors,

acoustic sensors, inductive loops) and on-board GPS receivers installed in vehicles. Clients of the Dynamic Map are various software modules performing such tasks as visualization, route planning, traffic optimization, object tracking and threat detection. The paper discusses experiences with an evaluation of the system architecture using the ATAM (Architectural Tradeoffs Analysis Method). The stages of evaluation comprise describing architectural views, identification of key scenarios and evaluation of risks of their realization.

Keywords: *architecture evaluation, ATAM, traffic monitoring, dynamic map*